12/5/17 "Hope is an accelerant."-Mrs. Lenoci

HW: "Implicit Differentiation"
Test 2 on Thursday 12/14

AIM: How do we find where there are horizontal tangents using Implicit Differentiation?

Warm Up:

1) Determine $\frac{dy}{dx}$ of $x^2y + 3xy^3 - x = 3$

$$2xy + x^2\frac{dy}{dx} + 3y^3 + 3x3y^2\frac{dy}{dx} - 1 = 0$$

$$2xy + 3y^3 - 1 = \frac{dy}{dx}\left(-x^2 - 3x3y^2\right)$$

$$\frac{2xy + 3y^3 - 1}{-x^2 - 3x3y^2} = \frac{dy}{dx}$$

$$\frac{2xy + 3y^3 - 1}{-x^2 - 9xy^2} = \frac{dy}{dx}$$

HW Check:

1) $y = x^2 + xy$

$$\frac{dy}{dx} = 2x + x\frac{dy}{dx} + 1y$$

$$-x\frac{dy}{dx} \qquad -x\frac{dy}{dx}$$

$$1\frac{dy}{dx} - x\frac{dy}{dx} = 2x + y$$

$$\frac{dy}{dx}(1 - x) = 2x + y$$

$$\frac{dy}{dx} = \frac{2x+y}{1-x}$$

2) $x^2y + y = 3$

$$2xy + x^2\frac{dy}{dx} + \frac{dy}{dx} = 0$$

$$\frac{dy}{dx}(x^2+1) = -2xy$$

$$\frac{dy}{dx} = \frac{-2xy}{x^2+1}$$

7) $x^3 + y^3 = \sqrt{5}$

$$3x^2 + 3y^2\frac{dy}{dx} = 0$$

$$3y^2\frac{dy}{dx} = -3x^2$$

$$\frac{dy}{dx} = \frac{-3x^2}{3y^2} = \frac{-x^2}{y^2}$$

HW from 12/5

11) $x^2+y^2=25$ $(3,-4)$

$$2x+2y\frac{dy}{dx}=0$$

$$\frac{2y\frac{dy}{dx}}{2y}=\frac{-\cancel{2}x}{\cancel{2}y}$$

$$\frac{dy}{dx}=\frac{-x}{y} \quad \frac{-3}{-4}=\frac{3}{4}$$

13) $x^2y=x+2$ $(2,1)$

$$2xy+x^2\frac{dy}{dx}=1$$

$$-2xy \qquad -2xy$$

$$\frac{x^2\frac{dy}{dx}}{x^2}=\frac{1-2xy}{x^2}$$

$$\frac{dy}{dx}=\frac{1-2xy}{x^2}$$

$$=\frac{1-2(2)(1)}{2^2}=\frac{-3}{4}$$

1) $x^2-y^2=1$

$$2x-2y\frac{dy}{dx}=0$$

$$2x=2y\frac{dy}{dx}$$

$$\frac{2x}{2y}=\frac{dy}{dx}$$

$$\frac{x}{y}$$

2) Find the equation of the tangent ~~line~~ line(s) to the curve from #1 when y=1

$$x^2y + 3xy^3 - x = 3$$

Point:

$$x^2(1) + \underbrace{3x(1)^3 - x}_{2x} = 3$$

$$x^2 + 2x = 3$$

$$x^2 + 2x - 3 = 0$$

$$(x+3)(x-1) = 0$$

$$x = -3 \quad x = 1$$

$$(-3,1) \quad (1,1)$$

$$\frac{dy}{dx} = \frac{2xy + 3y^3 - 1}{-x^2 - 9xy^2}$$

Slope

$(-3,1)$

$$= \frac{2(-3)(1) + 3(1)^3 - 1}{-(-3)^2 - 9(-3)(1)^2} = \frac{-4}{18} = \frac{-2}{9}$$

$(1,1)$

$$= \frac{2(1)(1) + 3(1)^3 - 1}{-(1)^2 - 9(1)(1)^2} = \frac{4}{-10} = -\frac{2}{5}$$

$$\boxed{(y-1) = \frac{-2}{9}(x - (-3))}$$ One tangent line

$$\boxed{(y-1) = \frac{-2}{5}(x-1)}$$ 2nd tangent line